

REMARKS

The abstract was objected to because it is more than 150 words and is more than one paragraph. A substitute abstract complying with the stated requirements has been submitted herewith. The objection to the abstract has thus been overcome.

Amendments to the claims are fully supported by the specification. Claims 1 and 14 have been broadened by deleting the reference to laser beam or electron beam. Claims 1 and 14 have been further amended to recite the carrier found in the patent application at page 4, line 7. Freeform sintering and/or freeform melting has been moved within claim 1. The compensation data set and/or function is determined before the freeform sintering and/or melting as set forth in the patent application at page 4, lines 12-16. ("is combined...to generate the control data set, which is then used to control the high-energy beam..."(emphasis added)) Stresses causing deformations is described at page 4, lines 4-8. The patent application at page 11, line 17 to page 12, line 22 describes calculations of the compensation data set or function to account for the deformations.

New claim 18 is directed to compensating for overhangs as set forth in Figs. 2 and 3 and described at page 10, line 18 through page 11, line 16.

Claims 1-14 have been rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. The claims have been amended to more specifically explain how the claimed methods and apparatus operate. In particular, it is specified that the determination of compensation data set and/or compensation function takes place before freeform sintering and/or freeform melting. Moreover, as to claims 1 and 14, calculations are specifically made with regard to deformations resulting from stresses within the layers due to different thermal expansion and consequent shrinking of the layers and occurring after the product is released from the carrier. The specification describes the calculation in greater detail with respect to Figs. 4-6. As for new claim 18, compensation is made for overhangs in which the below layer forms an angle of inclination of a plane tangent to the exterior with a layer being produced. The claim recites that the angle of inclination is used for determining the compensation data set and/or compensation function. The specification describes the calculation in greater detail with respect to Figs. 2 and 3. By combining the compensation data or function with the product target geometry data set, the thickness of the product can be reduced to compensate for melting spherules or partial

melting spherules on the thickness of the product or the product section to be produced.
(Patent application, page 4, lines 21-page 5, line 6)

The particular data set or function obviously depends on the geometry of the product to be manufactured. The specification provides specific guidance for the compensation function indicating, "A lower degree polynomial is used for simple geometry regions of the product to be produced, while a higher degree polynomial is used for complex geometry regions of the product to be produced." (page 5, lines 17-20). By combining the data compensation data or compensation function with the product target geometry data set, one is able to obtain a mathematically predetermined control data set for achieving the desired product in view of the expected manufacturing related effects of thermal expansion or melting. Given that the effects are predictable and that well known mathematics may be used to create a control data set, Applicants see no basis for the suggestion of the need for undue experimentation. The outcome of mathematical operations is well known and predictable and thus the enablement rejection should be withdrawn. The new and amended claims are supported by an enabling disclosure of the mathematical relationships that produce the compensated control data. The rejection under §112, first paragraph has been overcome.

Claims 1-14 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. The reference to a laser beam or an electron beam in claims 1 and 14 has been deleted by the present amendment. These claims now satisfy the definiteness requirement by reciting a high energy beam. The broad recitation encompassing any of at least, a laser or an electron beam provides a definite scope for the claims. With respect to claim 13, this claim has been cancelled making the rejection moot. Applicant submits that the present amendment overcomes the rejection based on Section 112, second paragraph.

Claims 1-11 were rejected under 35 U.S.C. §101 because the claimed invention was directed to non-statutory subject matter. Amended claim 1 and new claim 14 are now directed to a method for controlling a freeform layer by layer production apparatus. One of the elements in the claim includes freeform sintering and/or freeform melting by means of the high energy beam in accordance with the control data set. Thus, in accordance with the claims as presently presented, the layers of material are transformed into a product. In

addition, a machine, specifically a freeform layer by layer production apparatus is used. Thus, as amended these claims clearly satisfy the requirements of Section 101.

Claims 1-5 and 9-14 were rejected under 35 U.S.C. §102(b) as being anticipated by Liu. The claims have been amended to more clearly distinguish Applicants' invention over Liu. In particular, Applicants determine a compensation data set and/or a compensation function "before the freeform sintering and/or freeform melting begins." Compensation for manufacturing related effects are computed in advance of the production process so that the control data set for operating the production apparatus already takes into account such effects. Thus, according to Applicants' claimed invention it is not required to first produce an error during production of a layer and then to detect the error and only then compensate for this error in subsequent manufacturing steps of further layers.

Liu discloses a method for detection and rectification of layer variations. Liu's method involves monitoring the physical dimensions of the physical layers being deposited and feeding back the obtained data to the computer for recalculating new layer data. As set forth in paragraph 103 of Liu, "The data obtained are fed back periodically to the computer for recalculating new layer data. This option provides an opportunity to detect and rectify potential layer variations; such errors may otherwise cumulate during the building process, leading to some part inaccuracy." The approach taught by Liu is referred to as "adaptive layer slicing." Liu describes, "Periodically re-calculate another set of logical layers after periodically comparing the dimension data acquired by the sensor with the computer aided design representation in an adaptive matter." (Paragraph 50, Liu). In accordance with Applicant's invention, compensation is incorporated into the control data set before the production process begins. Liu does not address a system for computing compensation data from a product target geometry data set but rather focuses on a sensor means for detecting the dimension of a physical part of the product and to calculate new product data from such detected data. Thus, as amended, claims 1-5 and 9-14 fully distinguish over Liu. Claims 15-17 depend from claim 14 and should be allowed for the same reasons. New claim 18 also recites this patentable distinction.

Claims 6-8 were rejected under 35 U.S.C. §103(a) as being unpatentable over Liu in view of Riley. Riley does not overcome the deficiencies of Liu. As explained above with respect to claim 1, Applicants' invention is distinguished over the prior art in that

compensation is determined before the freeform sintering and/or freeform melting begins.
Thus for these same reasons, claims 6-8 are patentable over the art of record.

For all the foregoing reasons, Applicants submit that all claims presently in the application are patentable over the art of record and early notice to that effect is respectfully solicited.

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Respectfully submitted,

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